# sPHENIX tracking simulations status and plan

Tony Frawley
MAPS workshop, Santa Fe
January 5-7

# Tracking simulations pre-CD0

All simulations used in the pre-CD0 performance evaluations were made with a simplified model of the tracking detector:

Silicon tracking layers were perfect cylinders
- One cylinder of sensitive material, divided into cells during processing of hits
- One cylinder of copper to simulate average mass of other material

The TPC was divided into 60 cylindrical gas tracking layers, with cylinders standing in for the mass of the field cage.
- Gas voxels used for hits
- Drift to readout, readout shaping parameterized
- Introduce estimated space charge distortions (offset, width)
- Correct space charge distortions for hits pre-tracking

Hough transform + Kalman filter tracker optimized for cylindrical model

# Tracking simulations pre-CD0

All simulations used in the pre-CD0 performance evaluations were made with a simplified model of the tracking detector:

Silicon tracking layers were perfect cylinders
  • One cylinder of sensitive material, divided into cells during processing of hits
  • One cylinder of copper to simulate average mass of other material

The TPC was divided into 60 cylindrical gas tracking layers, with cylinders standing in for the mass of the field cage.
  • Gas voxels used for hits
  • Drift to readout, readout shaping parameterized
  • Introduce estimated space charge distortions (offset, width)
  • Correct space charge distortions for hits pre-tracking

Hough transform + Kalman filter tracker optimized for cylindrical model

Not crazy for a 1st pass, but it is time to move on to more realism

# Tracking simulation goals

Realistic tracking geometry:
  • Complete G4 model of MAPS detector ladders
  • Complete G4 model of INTT detector ladders
  • Best possible model of TPC
Proper handling of integration times in TPC, MAPS (pileup)
Proper handling of space charge distortion effects for TPC
Powerful tracking code:
  • Able to handle all space points from real ladders
  • Able to provide tracker with material budget per track
  • Able to correct TPC space charge distortions
      • Dead reckoning
      • Using info from silicon inner tracking detectors
Evaluate performance of the entire tracking system:
  • Pattern recog. in central Hijing events (incl. jet substructure!)
      • Role of the INTT in track matching MAPS/TPC
  • Mass resolution for the Upsilon states
  • DCA resolution (B-jet physics)
  • Effect of PID in TPC on tracker performance
      • open HF total cross sections possible with good tracking also?

# Tracking simulation goals - where are we?

Red = implemented

Realistic tracking geometry:
- Complete G4 model of MAPS detector ladders
- Complete G4 model of INTT detector ladders
- Best possible model of TPC (status?)

Proper handling of integration times in TPC, MAPS (pileup)
Proper handling of space charge distortion effects for TPC (partly)
Powerful tracking code:
- Able to handle all space points from real ladders (soon)
- Able to provide tracker with material budget per track
- Able to correct TPC space charge distortions
  - Dead reckoning
  - Using info from silicon inner tracking detectors

Evaluate performance of the entire tracking system:
- Pattern recog. in central Hijing events (incl. jet substructure!)
  - Role of the INTT in track matching MAPS/TPC
- Mass resolution for the Upsilon states
- DCA resolution (B-jet physics)
- Effect of PID in TPC on tracker performance
  - open HF total cross sections possible with good tracking also?

# Goal during this workshop

Integrate into the default simulations:

Realistic MAPS ladder geometry
Realistic INTT geometry
Pileup included in simulations
Tracking improvements:
  • Ability to handle space points from real ladders
    • Multiple hits/layer
  • Ability to provide tracker with material budget per track

The individual silicon ladder models and tracking software exist, we need to turn them all on and make sure everything works.

Some work needed still for track re-fitter to handle all ladders

# Goal during this workshop

Integrate into the default simulations:

Realistic MAPS ladder geometry
Realistic INTT geometry
Pileup included in simulations
Tracking improvements:
  • Ability to handle space points from real ladders
    • Multiple hits/layer
  • Ability to provide tracker with material budget per track

The individual silicon ladder models and tracking software exist, we need to turn them all on and make sure everything works.

Some work needed still for track re-fitter to handle all ladders

Then we will be able to carry out basic performance evaluations for the tracker using this new baseline model